CLAIMS

I claim:

1. An atmospheric pressure chemical vapor deposition furnace for depositing thin films on a workpiece at a temperature of 1200° C and above comprising:

a process chamber comprising a reflective interior surface for containing and reflecting heat back to heating elements, including means for actively cooling the process chamber surface such that a thermal response of the furnace is determined solely by thermal mass of the heating elements;

a plurality of linear heating elements disposed in one or more planar arrays within the process chamber and in proximity to the workpiece such that temperature difference (DT) between the workpiece and heating elements is minimized and the heating elements, with the reflective heat containment of the process chamber, approximate an isothermal chamber.

2. An atmospheric pressure furnace comprising:

an aluminum process chamber having an exterior surface and polished interior surfaces;

one or more elongated heating elements, extending through apertures in the process chamber to the exterior surface, said heating elements comprising Kanthal resistive wires protected by alumina ceramic tubing, and said resistive wires in each heating element extending longitudinally through the ceramic tubing such that the wires freely expand and contract in response to temperature changes;

cooling channels disposed in the exterior surface of the process chamber; and,

aluminum rails provided on interior surfaces of the process chamber, said rails positioned to slideably transport one or more workpieces from a receiving end of the process chamber to an exit end for continuous processing.

3. An atmospheric pressure furnace comprising:

a process chamber having highly polished interior surfaces defining an entrance, an exit and a processing region for a workpiece;

rails provided on opposed interior surfaces of the process chamber, said rails positioned for supporting a workpiece along an axis of travel from the entrance, through the processing region, and to the exit of the process chamber;

a first array of parallel, closely-spaced, elongated heating elements positioned below the rails;

a second array of parallel, closely-spaced, elongated heating elements positioned above the rails, wherein said first and second arrays of heating elements comprise resistive wires protected by ceramic tubing and the ends of the heating elements extend through apertures in the process chamber and are held in an external mounting structure for connection to an electric current; and

cooling channels disposed in the exterior surface of the process chamber..

4. A process chamber as in claim 3 wherein the process chamber comprises aluminum having highly polished interior surfaces for reflecting heat back to the processing region such that the temperature difference between the heating elements and the workpiece is minimized.

5. A furnace as in claim 3 wherein the polished interior surfaces are plated with gold.

6. A furnace as in claim 3 wherein the rails are made of aluminum.

7. A furnace as in claim 3 wherein the rails are made of molybdenum.

8. A furnace as in claim 3 wherein the resistive wires in each heating element extend longitudinally through the ceramic tubing such that the wires are free to expand and contract in response to temperature changes.

9. A furnace as in claim 3 wherein each heating element is a modular unit adapted for individual replacement without removing other heating elements.

10. A furnace as in claim 3 wherein the electrical connection to each heating element is made via threaded metal terminals incorporating short transverse rods that conformably engage recesses in the mounting structure to prevent inadvertent torque from causing damage to wires of the heating element.

11. A furnace as in claim 3 further comprising gas purge structures at the entrance and exit of the process chamber that prevent air from entering the process chamber while allowing the workpiece to pass through, thus enabling high-throughput processing.

12. A furnace as in claim 3 further comprising a thermal controller that can change the temperature in the process chamber from one temperature to another within a range of 800 - 1400 C in less than 30 minutes.

13. A furnace as in claim 3 further comprising a thermal controller which can cause the temperature in the process chamber to be cooled from more than about 1200 C to less than 800 C in less than 30 minutes.

14. A furnace comprising:

a process chamber comprising polished aluminum walls; and

one or more heating elements provided inside the chamber in direct proximity to a workpiece, the ends of the heating elements extending through apertures in the aluminum walls for receiving an electric current, such that the temperature of the heating elements and the workpiece exceed the melting temperature of the process chamber for more than 30 minutes during furnace operation.

15. A furnace as in claim 14 further comprising highly polished interior surfaces defining the process chamber for the purpose of reflecting heat upon a workpiece; and

cooling channels conformably disposed in the exterior surfaces of the walls for removing non-reflected heat, such that the reflectivity of the polished interior surfaces does not decrease as the process temperature of the furnace increases.